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SOLAR REFLECTORS ABOUT THE SUN-EARTH ARTIFICIAL COLLINEAR EQUILIBRIUM POINTS

Abstract

Simple climate models help to explain the natural variability of the Earth's climate system. These models show that Earth's climate can switch from a stable warm state to a cool state and is sensitive to relative small changes in solar insolation. The periodicity of ice ages (Milankovitch cycles) can be explained by these processes. Similarly, volcanic activity can have a significant short-term cooling effect, such as Tambora in 1815. However, if a period similar to the 'little ice age' (1645-1715) recurred, or indeed future large volcanic events there could be significant economic consequences for energy and agriculture. Therefore, active strategies to avoid such short-term climate change may be useful. Several space-based climate engineering methods, including the use of orbital reflectors deployed in sun-synchronous polar orbits to increase the total insolation of the Earth for climate warming have been considered to modify the mean Earth's temperature in a controller manner. However, in these studies only the gravitational force of the Earth, i.e. the two body problem, and the solar radiation pressure have been considering. Indeed, previous studies have demonstrated that families of Sun-Earth artificial Lagrange points may be generated using solar sail spacecraft in the three-body problem. Therefore, in this work, solar reflectors about the Sun-Earth artificial collinear equilibrium points are proposed to intervene in the Earth's climate system, such that the diameter of the spot projected on the Earth's surface must be less than the Earth's diameter and the mirror attitude redirects the sunlight towards the Earth. A resulting three-dimensional family of halo orbits are investigated using the Lindstedt–Poincaré method to obtain a third order-approximate solution.